IN THE CLAIMS:

Please amend the claims as follows. Claims 25–30, 32-37 and 39-66 are re-presented for convenience. Claims 67-76 have been added.

25. (Previously Presented) An apparatus for sensing fluid flow within a pipe, comprising:

an acoustic sensing device for providing an acoustic signal indicative of the speed of sound in the fluid flowing within the pipe, wherein the acoustic device is attached to the outside wall of the pipe; and

a flow velocity sensing device coupled to the acoustic device for providing a velocity signal indicative of the speed of the fluid flowing within the pipe, wherein the flow device is attached to the outside wall of the pipe.

26. (Previously Presented) The apparatus of claim 25, further comprising an optical source optically connected to the apparatus for providing optical power to the acoustic sensing device and the flow velocity sensing device.

27. (Previously Presented) The apparatus of claim 25, further comprising a housing attached to the pipe for enclosing the sensing devices.

28. (Previously Presented) The apparatus of claim 27, wherein the housing comprises a pressure vessel.

29. (Previously Presented) The apparatus of claim 27, wherein the housing is filled with air, nitrogen, or argon.

30. (Previously Presented) The apparatus of claim 25, wherein the pipe is sufficiently compliant so that the sensing devices may sense the speed of sound in the fluid and the speed of the fluid through the wall of the pipe.

31. (Canceled)

32. (Previously Presented) The apparatus of claim 25, wherein the acoustic sensing device comprises a plurality of sensors.

33. (Previously Presented) The apparatus of claim 32, wherein the sensors are spaced equidistantly apart.

34. (Previously Presented) The apparatus of claim 32, wherein the sensors are spaced to sense acoustic pressure variations traveling at the speed of sound in the fluid.

35. (Previously Presented) The apparatus of claim 32, wherein the sensors comprise optical fiber sensors.

36. (Previously Presented) The apparatus of claim 35, wherein each sensor comprises at least one coil of optical fiber wrapped around the circumference of the pipe.

37. (Previously Presented) The apparatus of claim 36, wherein each sensor is separated by at least one fiber Bragg grating.

38. (Canceled)

39. (Previously Presented) The apparatus of claim 25, wherein the flow velocity sensing device comprises a plurality of sensors.

40. (Previously Presented) The apparatus of claim 39, wherein the sensors are spaced equidistantly apart.

41. (Previously Presented) The apparatus of claim 39, wherein the sensors are spaced to sense local pressure variations traveling with the fluid in the pipe.

42. (Previously Presented) The apparatus of claim 39, wherein the sensors comprise optical fiber sensors.

43. (Previously Presented) The apparatus of claim 42, wherein each sensor comprises at least one coil of optical fiber wrapped around the circumference of the pipe.

44. (Previously Presented) The apparatus of claim 43, wherein each sensor is separated by at least one fiber Bragg grating.

45. (Previously Presented) The apparatus of claim 25, wherein the acoustic sensing device and the flow velocity sensing device are coupled by a fiber optic cable.

46. (Previously Presented) The apparatus of claim 25, wherein the acoustic sensing device and the flow velocity sensing device are multiplexed along a common fiber optic cable.

47. (Currently Amended) An apparatus for sensing fluid flow ~~within a pipe~~, comprising:

a housing;

an acoustic sensing device within the housing to sense acoustic pressure variations traveling at the speed of sound in ~~the~~ fluid flowing through the housing, the acoustic sensing device providing an ~~acoustic~~ optical signal indicative of the speed of sound in the fluid; and

a flow velocity sensing device within the housing to sense local pressure variations traveling with the fluid flowing through the housing, the flow velocity sensing device providing ~~a velocity~~ an optical signal indicative of the velocity of the fluid flowing in the pipe.

48. (Previously Presented) The apparatus of claim 47, further comprising an optical source optically connected to the apparatus for providing optical power to the acoustic sensing device and the flow velocity sensing device.

49. (Currently Amended) The apparatus of claim 47, ~~further comprising a housing attached to the pipe for enclosing the sensing devices~~ wherein the housing is adapted to attach in line with the pipe.

50. (Currently Amended) The apparatus of claim ~~49~~ 47, wherein the housing comprises a pressure vessel.

51. (Currently Amended) The apparatus of claim ~~49~~ 47, wherein the housing is filled with air, nitrogen, or argon.

52. (Previously Presented) The apparatus of claim 47, wherein the pipe is sufficiently compliant so that the sensing devices may sense the acoustic pressure variations and the local pressure variations through the wall of the pipe.

53. (Previously Presented) The apparatus of claim 47, wherein the acoustic sensing device comprises a plurality of sensors.

54. (Previously Presented) The apparatus of claim 53, wherein the sensors are spaced equidistantly apart.

55. (Previously Presented) The apparatus of claim 53, wherein the sensors are spaced to sense acoustic pressure variations traveling at the speed of sound in the fluid.

56. (Previously Presented) The apparatus of claim 53, wherein the sensors comprise optical fiber sensors.

57. (Previously Presented) The apparatus of claim 56, wherein each sensor comprises at least one coil of optical fiber wrapped around the circumference of the pipe.

58. (Previously Presented) The apparatus of claim 57, wherein each sensor is separated by at least one fiber Bragg grating.

59. (Previously Presented) The apparatus of claim 47, wherein the flow velocity sensing device comprises a plurality of sensors.

60. (Previously Presented) The apparatus of claim 59, wherein the sensors are spaced equidistantly apart.

61. (Previously Presented) The apparatus of claim 59, wherein the sensors are spaced to sense local pressure variations traveling with the fluid in the pipe.

62. (Previously Presented) The apparatus of claim 59, wherein the sensors comprise optical fiber sensors.

63. (Previously Presented) The apparatus of claim 62, wherein each sensor comprises at least one coil of optical fiber wrapped around the circumference of the pipe.

64. (Previously Presented) The apparatus of claim 63, wherein each sensor is separated by at least one fiber Bragg grating.

65. (Previously Presented) The apparatus of claim 47, wherein the acoustic sensing device and the flow velocity sensing device are coupled by a fiber optic cable.

66. (Previously Presented) The apparatus of claim 47, wherein the acoustic sensing device and the flow velocity sensing device are multiplexed along a common fiber optic cable.

67. (New) A system for sensing fluid flowing in a pipe, comprising:

a first array of optical sensors responsive to acoustic pressure variations in the fluid;

a second array of optical sensors responsive to local pressure variations traveling with the fluid; and

signal processing circuitry coupled with the first and second array of optical sensors, wherein the signal processing circuitry is adapted to calculate a speed of sound in the fluid based on light reflected from the first array of optical sensors and to calculate a velocity of the fluid based on light reflected from the second array of optical sensors.

68. (New) The system of claim 67, wherein the signal processing circuitry is further configured to determine a phase fraction of one or more constituents in the fluid, based on the calculated speed of sound in the fluid and the calculated velocity of the fluid.

69. (New) The system of claim 67, wherein the first and second arrays are coupled to the signal processing circuit via a common optical fiber.

70. (New) The system of claim 67, wherein optical sensors of the first array are spaced farther apart than optical sensors of the second array.

71. (New) The system of claim 70, wherein optical sensors of the first array are spaced approximately ten times farther apart than optical sensors of the second array.

72. (New) The system of claim 67, wherein the first and second arrays of optical sensors each comprise one or more coils of optical fiber wrapped one or more turns around a circumference of the pipe.

73. (New) The system of claim 72, wherein the first and second arrays of optical sensors each comprise pairs of reflective devices at opposite ends of the coils, wherein each pair of reflective devices and a corresponding coil form an interferometer sensor.

74. (New) The system of claim 73, wherein the reflective devices comprise fiber Bragg gratings.

75. (New) The system of claim 74, wherein at least two pairs of fiber Bragg gratings have a common reflection wavelength.

76. (New) The system of claim 74, wherein at least two pairs of fiber Bragg gratings have different reflection wavelengths.